METHOD OF CHANGING DRIVING SEQUENCE TO OUTPUT CHARGE COUPLE DEVICE SIGNAL

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The invention relates in general to method of scanning and outputting a charge couple device signal, and more particularly, to a method of outputting a charge couple device signal by changing the period of the driving sequence.

Description of the Related Art

[0002] In a normal color scanner, a color charge couple device (CCD) is used as an optical sense device. The color charge couple device is formed of several sensor cells to sense the intensities of the red (R), green (G) and blue (B) primary color lights. Figure 1A shows a linear charge couple device. The first row of sensor cells 102 of the linear charge coupled device is used to detect the R light intensity. The second row of sensor cells 104 is to detect the green light intensity, and the third row of sensor cells 106 is used to detect the blue light intensity. After a period of exposure time, different amounts of charges are accumulated according to the light intensities detected by the sensor cells. A charge signal formed by the charges is sent to a register within the period of a dump sequence. Figure 2A shows the sequence of conventional linear charge coupled device signals. When the dump sequence SH is high, the charge signals of the first row of sensor cells 102 are sent to the register 108. Meanwhile, the charge signals of the second row of sensor cells 104 are sent to the register 110, and the charge signals of the third row of

sensor cells 106 are sent to the register 112. According to Figure 2A, in period T1 of driving signals $\phi 1$ and $\phi 2$ (using the rising edge of the signal as the data transmitting point), the register 108 sends the charge signal S1 to the pixel processing circuit 114. Similarly, in period T2, the charge signal S2 is sent to the pixel processing circuit 114. The charge signals in the register 108 are thus sequentially sent to the pixel processing circuit 114. During a pixel sampling sequence, the pixel processing circuit 114 sends the charge signal S1 to a subsequent circuit at the period TS1, and sends the charge signal S2 to a subsequent circuit at the period TS2. Thereafter, the charge signals are sequentially output to the subsequent circuit. The registers 110, 112, and the pixel processing circuits 116 and 118 are similar to the above description.

[0003] In Figure 1B, the stagger charge couple device has six rows of sensor cells 122, 124, 126, 128, 130 and 132. The first and second rows of sensor cells 122 and 124 are to detect the red light intensities. The third and fourth rows of sensor cells 126 and 128 are to detect the green light intensities. The fifth and the sixth rows of sensor cells 130 and 132 are to detect the blue light intensities. After a certain exposure time, different amounts of charges are accumulated according to the light intensities detected by the sensor cells 122 to 132. Fig. 2B shows the sequence of the stagger charge couple device signals. When the dump sequence SH is high, the charge signals of the first, second, third, fourth, fifth and sixth rows of sensor cells 122 to 132 are sent to the registers 134, 136, 138, 140, 142 and 144, respectively. In the period T11 of the driving sequences $\phi 1$ and $\phi 2$, the register 134 sends the charge signal S1 to the pixel processing circuit 146. The charge signal S3 is sent to the pixel processing circuit 146 in the period T12. The register 136 sends the charge signal S2 to the pixel processing circuit 146 in the period T21 of the

driving sequences $\phi 1$ and $\phi 2$. The charge signal S4 is sent to the pixel processing circuit 146 in the period T22. Thereafter, the charge signals of the register 134 are sequentially sent to the pixel processing circuit 146. During thepixel sampling sequence, the pixel processing circuit 146 outputs the charge signals S1 and S2 to the subsequent circuit at the period TS1 and TS2, respectively. The registers 126, 128, 130, 132 and the pixel processing circuits 148 and 150 are similar to the above.

[0004] Figure 3 shows a block diagram of a scanner. In Figure 3, the sensor 302 converts the charge signal detected by the charge couple device into an analog voltage signal. Using an analog/digital converter 304, the analog voltage signal output from the sensor 302 is converted into a digital voltage signal. An application specified integrated circuit 306 and a compensation RAM 310 perform a calculation on the compensation value and the digital voltage signal. The calculated video signal is stored into a video RAM 308. The data of the image signal is then read from the video RAM 308 by the application specified integrated circuit 306, and sent to the I/O port 312.

[0005] When the scanner is scanning a video document, a high resolution is not always required. Without changing the scanner structure (that is, the amount of the sensor cells in each row of the charge couple device), the sampling sequence of the analog/digital converter is changed. That is, the scanning optical resolution is reduced to one half, and the sampling sequence of the analog/digital converter is reduced to one half. Or alternatively, the scanning optical resolution is reduced to one quarter, and the sampling sequence of the analog/digital converter is reduced to one quarter. When the optical resolution of the scanner is reduced, and the sampling time of the analog/digital converter

is not reduced, the scanning time of the scanner is not reduced, that is, the scanner does not have the function of high scanning speed at low optical resolution.

SUMMARY OF THE INVENTION

[0006] The invention provides a method of changing a driving sequence to output a charge couple device applied to a scanner. The scanner has a pixel processor and a charge couple device. According to the driving sequence, a plurality of charge signals detected by the charge couple device is output to the pixel processor sequentially. The pixel processor then sequentially outputs the charge signals according to a sampling sequence. The method of changing the driving sequence to output the charge couple device signal includes the following steps. A fast driving sequence is provided. The period of the fast driving sequence is 1/N of the period of the original driving sequence. During the fast driving sequence, the charge signal is sent to the pixel processor. The charge signal is then sampled at the pixel processor according to the sampling sequence. The data obtained by sampling is output, such that the scanner possesses the high scanning speed function at a low optical resolution.

[0007] Both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Figure 1A shows a linear charge couple device;

[0009] Figures 1B shows a stagger charge couple device

[0010] Figures 2A shows the sequence of the conventional linear charge coupled device signal;

[0011] Figure 2B shows the sequence of the conventional stagger charge device signal;

[0012] Figure 3 is a block diagram of a scanner;

[0013] Figure 4A shows that the period of the driving sequence becomes one half of the original value;

[0014] Figure 4B shows that the period of the driving sequence becomes one fourth of the original value; and

[0015] Figure 4C shows that the period of the driving sequence becomes one eighth of the original value.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] In this embodiment, a stagger charge couple device is used as an example (the linear charge couple device has different number of rows of sensor cells), of which the structure is illustrated as Figure 2B. At the descending edge of the driving sequence, the register sends the charge signal to the video processor. After exposing the stagger charge couple device within a period of time, different amounts of charges are accumulated according to the light intensity detected by the sensor cells. The charge signals formed by the charges are all sent to the register within a period of a dump sequence. In Figure 4A, the period of the driving sequence is reduced to one half. When the dump sequence SH is high, the first row of sensor cells 122 outputs the charge signal to the register 134. The charge signals of the second row of the sensor cells 124 are sent to

the register 136. Within the period T1 of the driving sequences $\phi 1$, $\phi 2$, the charge signal S1 is sent to the pixel processor 146, which then outputs the charge signal S1 to a subsequent circuit within the period T1 of the pixel sampling sequence. The register 134 sends the charge signal to the pixel processor 146 within the period T3 of the register 134. The pixel processor 146 outputs the charge signal S3 to the subsequent circuit within the period T3 of the pixel sampling sequence. The register 136 sends the charge signal S2 to the pixel processor 146 within the period T2 of the driving sequence $\phi 1$, $\phi 2$. The pixel processor 146 outputs the charge signal S2 to the subsequent circuit within the period T2 of the pixel sampling sequence. The register 136 sends the charge signal S4 to the pixel processor 146 within the period T4 of the driving sequence $\phi 1$, $\phi 2$. The pixel processor 146 outputs the charge signal S4 to the subsequent circuit within the period T4 of the pixel sampling sequence. The subsequent sequence operation is similar.

[0017] When only one half of the optical resolution is required, the period of the driving sequence is one half of the original one. In Figure 4A, the register 134 sends the charge signal S1 to the pixel processor 146 within the period T21 of the driving sequence $\phi 1/2$, $\phi 2/2$. The register 136 sends the charge signal S2 to the pixel processor 146 within the period T22 of the driving sequence $\phi 1/2$, $\phi 2/2$. The pixel processor 146 outputs the charge signal S2 to the subsequent circuit within the period T1 of the pixel sampling sequence. The register 134 sends the charge signal S3 to the pixel processor 146 within the period T23 of the driving sequence $\phi 1/2$, $\phi 2/2$. The register 136 sends the charge signal S4 to the pixel processor 146 within the period T24 of the driving sequence $\phi 1/2$, $\phi 2/2$. The pixel processor 146 outputs the charge signal S4 to the subsequent circuit within the period T2 of the pixel sampling sequence. Thus, the charge signal of the even

number of rows of sensor cells can be output to the subsequent circuit, so that the optical resolution of the scanner is reduced to a half.

[0018] If the charge signals of the odd number of row of sensor cells are sent to the subsequent circuit, the driving sequence $\phi 1/2$, $\phi 2/2$ is shifted by 180°. In Figure 4A, the register 134 sends the charge signal S1 to the pixel processor 146 within the period T22 of the driving sequence $\phi 1/2+\pi$, $\phi 2/2+\pi$. The pixel processor 146 then outputs the charge signal S1 to the subsequent circuit within the period T1 of the pixel sampling sequence. The register 136 sends the charge signal S2 to the pixel processor 146 within the period T23 of the driving sequence $\phi 1/2+\pi$, $\phi 2/2+\pi$. The register 134 sends the charge signal S3 to the pixel processor 146 within the period T24 of the driving sequence $\phi 1/2+\pi$, $\phi 2/2+\pi$. The pixel processor 146 then outputs the charge signal S3 to the subsequent circuit within the period T2 of the pixel sampling sequence. The operation of the subsequent sequences is similar.

[0019] When only one fourth of the optical resolution of the scanner is required, that is, when the period of the driving sequence becomes one fourth of the original one as shown in Figure 4B, the register 134 sends the charge signal S1 to the pixel processor 146 within the period T41 of the driving sequence $\phi 1/4$, $\phi 2/4$. Meanwhile, the register 136 sends the charge signal S2 to the pixel processor 146 within the period T42 of the driving sequence $\phi 1/4$, $\phi 2/4$. The register 134 sends the charge signal S3 to the pixel processor 146 within the period T43 of the driving sequence $\phi 1/4$, $\phi 2/4$. The register 136 sends the charge signal S4 to the pixel processor 146 within the period T44 of the driving sequence $\phi 1/4$, $\phi 2/4$. The pixel processor 146 then outputs the charge signal S4 to the subsequent circuit within the period T1 of the pixel sampling sequence. The register 134 sends the

charge signal S5 to the pixel processor 146 within the period T45 of the driving sequence $\phi 1/4$, $\phi 2/4$. The register 136 sends the charge signal S6 to the pixel processor 146 within the period T46 of the driving sequence $\phi 1/4$, $\phi 2/4$. The register 134 sends the charge signal S7 to the pixel processor 146 within the period T47 of the driving sequence $\phi 1/4$, $\phi 2/4$. The register 136 sends the charge signal S8 to the pixel processor 146 within the period T48 of the driving sequence $\phi 1/4$, $\phi 2/4$. The pixel processor 146 then outputs the charge signal S8 to the subsequent circuit within the period T2 of the pixel sampling sequence. Thus, the charge signals of every other four of the sensor cells is output to the subsequent circuit to reduce the optical resolution of the scanner into one fourth.

[0020] If the third sensor cell is the initial position to output, and the charge signal of every other four sensor cells is sent to the subsequent circuit, the driving sequence is shifted by 180°. In Figure 4B, the register 134 sends the charge signal S1 to the pixel processor 146 within the period T42 of the driving sequence $\phi 1/4+\pi$, $\phi 2/4+\pi$. The register 136 sends the charge signal S2 to the pixel processor 146 within the period T43 of the driving sequence $\phi 1/4+\pi$, $\phi 2/4+\pi$. The register 134 sends the charge signal S3 to the pixel processor 146 within the period T44 of the driving sequence $\phi 1/4+\pi$, $\phi 2/4+\pi$. The pixel processor 146 then outputs the charge signal S3 to the subsequent circuit within the period T1 of the pixel sampling sequence. The register 136 sends the charge signal S4 to the pixel processor 146 within the period T45 of the driving sequence $\phi 1/4+\pi$, $\phi 2/4+\pi$. The register 134 sends the charge signal S5 to the pixel processor 146 within the period T46 of the driving sequence $\phi 1/4+\pi$, $\phi 2/4+\pi$. The register 136 sends the charge signal S6 to the pixel processor 146 within the period T47 of the driving sequence $\phi 1/4+\pi$, $\phi 2/4+\pi$. The register 134 sends the charge signal S7 to the pixel processor 146 within the period

T48 of the driving sequence $\phi 1/4+\pi$, $\phi 2/4+\pi$. The pixel processor 146 then outputs the charge signal S7 to the subsequent circuit within the period T2 of the pixel sampling sequence. Thereby, the third sensor cell is the output initial position and the charge signal of every other four sensor cells is output to the subsequent circuit.

[0021] If the second sensor cell is the initial position for output, and the charge signal of every other four sensor cells is sent to the subsequent circuit, the driving sequence $\phi 1/4$, $\phi 2/4$ is shifted by 360°. In Figure 4B, the register 134 sends the charge signal S1 to the pixel processor 146 within the period T43 of the driving sequence $\phi 1/4+2\pi$, $\phi 2/4+2\pi$. The register 136 sends the charge signal S2 to the pixel processor 146 within the period T44 of the driving sequence $\phi 1/4+2\pi$, $\phi 2/4+2\pi$. The pixel processor 146 then outputs the charge signal S2 to the subsequent circuit within the period T1 of the pixel sampling sequence. The register 134 sends the charge signal S3 to the pixel processor 146 within the period T45 of the driving sequence $\phi 1/4+2\pi$, $\phi 2/4+2\pi$. The register 136 sends the charge signal S4 to the pixel processor 146 within the period T46 of the driving sequence $\phi 1/4+2\pi$, $\phi 2/4+2\pi$. The register 134 sends the charge signal S5 to the pixel processor 146 within the period T47 of the driving sequence $\phi 1/4+2\pi$, $\phi 2/4+2\pi$. The register 136 sends the charge signal S6 to the pixel processor 146 within the period T48 of the driving sequence $\phi 1/4+2\pi$, $\phi 2/4+2\pi$. The pixel processor 146 then outputs the charge signal S6 to the subsequent circuit within the period T2 of the pixel sampling sequence. Thereby, the second sensor cell is the output initial position and the charge signal of every other four sensor cells is output to the subsequent circuit.

[0022] When the scanner requires only one eighth of the optical resolution, the period of the driving sequence becomes one eighth. Figure 4C shows the sequence with a

period one eighth of the original one. In Figure 4C, the sixth sensor cell is used as the initial position, and the charge signal of every other eight sensor cells is output to the subsequent circuit. The driving sequence $\phi 1/8$, $\phi 2/8$ is shifted by 360°.

[0023] The register 134 sends the charge signal S1 to the pixel processor 146 within the period T83 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 136 sends the charge signal S2 to the pixel processor 146 within the period T84 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 134 sends the charge signal S3 to the pixel processor 146 within the period T85 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 136 sends the charge signal S4 to the pixel processor 146 within the period T86 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 134 sends the charge signal S5 to the pixel processor 146 within the period T87 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 136 sends the charge signal S6 to the pixel processor 146 within the period T88 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The pixel processor 146 then outputs the charge signal S6 to the subsequent circuit within the period T1 of the pixel sampling sequence. The register 134 sends the charge signal S7 to the pixel processor 146 within the period T89 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 136 sends the charge signal S8 to the pixel processor 146 within the period T810 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 134 sends the charge signal S9 to the pixel processor 146 within the period T811 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 136 sends the charge signal S10 to the pixel processor 146 within the period T812 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 134 sends the charge signal S11 to the pixel processor 146 within the period T813 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 136 sends the charge signal S12 to the pixel processor 146 within

the period T814 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 134 sends the charge signal S13 to the pixel processor 146 within the period T815 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The register 136 sends the charge signal S14 to the pixel processor 146 within the period T816 of the driving sequence $\phi 1/8+2\pi$, $\phi 2/8+2\pi$. The pixel processor 146 then outputs the charge signal S146 to the subsequent circuit within the period T2 of the pixel sampling sequence. Thus, the sixth sensor cell is used as the initial position for output, and the charge signal of every other eight sensor cells is sent to the subsequent circuit. The optical resolution of the scanner is reduced to one eighth.

[0024] According to the above, by changing the period of the driving sequence of the charge couple device, the optical resolution of the scanner can be changed. A phase shift can be performed to the period of the driving sequence to determine which sensor cell is the initial position to output the charge signal thereof to the subsequent circuit.

[0025] When the scanner is scanning a video document without the requirement of a high resolution, the period of the driving sequence of the charge signal output from the charge coupled device is changed without changing the structure of the scanner. For example, when the optical resolution is reduced to one half, the period of the driving sequence is reduced to one half. When the optical resolution is reduced to one fourth, the period of the driving sequence is reduced to one fourth. When the optical resolution is reduced, the sampling sequence of the analog/digital converter and the operation sequence of the application specific integrated circuit are not changed. Therefore, with the same amount of sampling and processing of data, the scanning speed is increased to output the charge signal by the same amount before reducing the optical resolution. The scanner can thus possess the function of high scanning speed at low optical resolution.

[0026] The advantage of the invention is to have the function of high scanning speed of the scanner even when the optical resolution is low.

[0027] Other embodiments of the invention will appear to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples are to be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.